

INTERNATIONAL COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE
in its capacity as elected Office

Date of mailing (day/month/year) 04 April 2001 (04.04.01)	
International application No. PCT/DK00/00376	Applicant's or agent's file reference P 99 035 WO
International filing date (day/month/year) 07 July 2000 (07.07.00)	Priority date (day/month/year) 12 July 1999 (12.07.99)
Applicant JOHANSEN, Oluf, Peter, Kaad	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

05 February 2001 (05.02.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Céline Faust Telephone No.: (41-22) 338.83.38
--	---

REPLACED BY
ART 34 AMDT

Patent Claims

17

1. Directional high-voltage detector (5) for a high-voltage conductor (10) comprising

5

- at least one voltage-measuring circuit for measuring voltage in said conductor (10),

- at least one current-measuring circuit for measuring
10 current in said conductor (10)

- and means for determining the energy flow in the conductor (10) on the basis of measurements made by said voltage-measuring circuit and said current-measuring circuit.
15

2. Directional high-voltage detector according to claim 1, characterised in that the voltage-measuring circuit comprises at least one capacitive
20 detector (11) which forms a capacitive coupling with the conductor (10).

3. Directional high-voltage detector according to claim 2, characterised in that the capacitive
25 detector (11) comprises a metal plate (20) covering a section of the conductor (10) partially or totally.

4. Directional high-voltage detector according to claim 3, characterised in that the edges or corners
30 of the plate are bent away from the conductor (10).

5. Directional high-voltage detector according to claim 1, characterised in that the dielectric material between the metal plate (20) and the conductor (10) is silicone covering the surface of said detector
5 partially or totally.

6. Directional high-voltage detector according to claim 5, characterised in that the silicone layer serves as an isolation layer between the high-voltage
10 potentials in said detector and the exterior, respectively.

7. Directional high-voltage detector according to claim 1, characterised in that at least one
15 capacitor (12) is connected serially to the capacitive coupling (11) and a reference potential (13), respectively.

8. Directional high-voltage detector according to claim 20 7, characterised in that the reference potential (13) is the ground potential of at least one conductor.

9. Directional high-voltage detector according to claim 25 1, characterised in that the current-measuring circuit comprises at least one detector (14) for measuring the magnetic field generated by the current in the conductor (10).

30 10. Directional high-voltage detector according to claim 1, characterised in that the magnetic field detector (14) comprises two hall elements (15, 16).

11. Directional high-voltage detector according to claim 1, characterised in that the supply lines for the magnetic field detector (15, 16) and the calculation circuit (17) comprise shields (21) against
5 magnetic fields.

12. Directional high-voltage detector for a high-voltage conductor comprising

- 10 • at least one voltage-measuring circuit for measuring voltage in said conductor (10) by means of at least one capacitive detector (11),
- at least one current-measuring circuit for measuring
15 current in said conductor (10) by means of at least one magnetic field detector (14, 15, 16),
- and means (17) for determining the energy flow in the conductor (10) on the basis of measurements by said
20 voltage-measuring circuit and said current-measuring circuit.

13. Directional high-voltage detector according to claim 12, characterised in that said means
25 (17) determine the energy flow direction on the basis of the polarities of the current and voltage between two preceding zero-crossings of the voltage.

14. Apparatus for measuring on a high-voltage
30 conductor (10) comprising

- at least one voltage-measuring circuit for measuring voltage in said conductor (10) by means of at least one capacitive detector (11),
 - 5 • at least one current-measuring circuit for measuring current in said conductor (10) by means of at least one magnetic field detector (14, 15, 16)
 - and means for determining the energy flow in the
10 conductor (10) on the basis of measurements by said voltage-measuring circuit and said current-measuring circuit.
15. Apparatus for measuring on a conductor (10)
15 comprising
- at least one voltage-measuring circuit for measuring voltage in said conductor (10) by means of at least one capacitive detector (11),
20
 - at least one current-measuring circuit for measuring current in said conductor (10) by means of at least one magnetic field detector (14, 15, 16)
 - 25 • and means for determining the energy flow in the conductor (10) on the basis of measurements by said voltage-measuring circuit and said current-measuring circuit.
- 30 16. Apparatus for measuring on a conductor (10) according to claim 15, characterised in that

the magnetic field detector (14) comprises at least one magnetic-resistant detector (15, 16).

17. High-voltage fault detector for a high-voltage
5 conductor (10) wherein said detector comprises means for determining the direction of an energy flow in said conductor (10).

18. Method for determining the direction of an
10 energy flow in a high-voltage conductor wherein at least one voltage-measuring circuit measures voltage in said conductor by means of at least one capacitive detector, at least one current-measuring circuit measures current in said conductor by means of a magnetic field detector
15 and a calculation circuit calculating a direction value derived from the measured voltage and current.

19. Method for determining the direction of an
energy flow in a high-voltage conductor according to
20 claim 18, characterised in that the calculation circuit calculates the direction value on the basis of the polarities of the current and the voltage between two preceding zero-crossings of the voltage.

25 20. Method for determining the direction of an energy flow in a high-voltage conductor wherein at least one current-measuring circuit measures current, at least one voltage-measuring circuit measures voltage, where a calculation circuit divides said voltage into a number of
30 samples within a period of time and where said calculation circuit compares the first voltage sample value numerically larger than a constant value with the

immediately preceding values to determine the sample value closest to zero voltage.

21. Method for determining the direction of the energy flow in a high-voltage conductor according to claim 20, characterised in that the calculation circuit calculates the direction value on the basis of the polarities of the current and voltage between two preceding zero-crossings of the voltage.

10

22. Method for determining the direction of the energy flow in a high-voltage conductor according to claim 21, characterised in that the constant value exceeds the noise level.

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT



(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P 99 035 WO		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/DK00/00376	International filing date (day/month/year) 07/07/2000	Priority date (day/month/year) 12/07/1999	
International Patent Classification (IPC) or national classification and IPC G01R15/16			
Applicant JOMITEK ApS et al.			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
- These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 05/02/2001	Date of completion of this report 05.10.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer O'Callaghan, F Telephone No. +49 89 2399 6512 

INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

International application No. PCT/DK00/00376

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-16 as originally filed

Claims, No.:

1-19 with telefax of 07/09/2001

Drawings, sheets:

1/7-7/7 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☒ the claims, Nos.: 20-22

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/DK00/00376

☐ the drawings, sheets:

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

see separate sheet

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims 1-19
	No: Claims
Inventive step (IS)	Yes: Claims
	No: Claims 1-19
Industrial applicability (IA)	Yes: Claims 1-19
	No: Claims

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET

International application No. PCT/DK00/00376

Re Item I

The amendments filed with the fax dated 07.09.2001 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT. The amendments concerned are the following:

1. Claims 1, 15: "...between two zero-crossings of the voltage **or the current**". In the original application only "...zero-crossings of the voltage" were disclosed. No basis for this amendment can be found in the original disclosure.

Re Item V

Insofar as the claims can be understood (see Item VIII below), the following analysis is made:

Reference is made to the following documents:

D1: CN 1 195 775 A

D2: DE 31 45 255 A

D3: US 5 438 256 A

D4: EP 0 809 115 A

1. Claim 1: D1 (see abstract) discloses a directional high-voltage detector for a high-voltage conductor comprising at least one voltage-measuring circuit for measuring voltage in said conductor, at least one current-measuring circuit for measuring current in said conductor and means for determining the energy flow [direction] in the conductor on the basis of measurements made by said voltage-measuring circuit and said current-measuring circuit.

D1 does not explicitly disclose that the means for determining the energy flow direction does so on the basis of the polarities of the current and voltage between preceding two zero-crossings of the voltage.

However, D1 already discloses the multiplication of the current and voltage values. An integration is subsequently performed with the result being either positive or negative. To the skilled person, this would suggest the contemplation of the respective polarity of the current and voltage values. An obvious way to

detect polarity of a voltage is to detect the zero-crossings. Although D1 teaches the integration of the values resulting from the multiplication in order to obtain a value for the fault energy, the skilled person would readily realise that information on the flow direction is already present after the multiplication. Thus, if desirous only of information on the energy flow direction and not of the total energy involved, said skilled person would, without exercising inventive skill, and having determined the polarities, just perform the multiplication as taught by D1 and thus he would arrive at the solution of present claim 1.

2. Claim 15: The above evaluation of claim 1, also applies mutatis mutandis to independent method claim 15. Further, the respective choice of the voltage measurement means to be a capacitive detector and the current measurement means to be a magnetic field detector cannot be regarded as involving an inventive step as such means are well known to the skilled person. For example purposes, see D2, (Fig.1 and abstract) for a capacitive detector for measuring voltage in a similar arrangement, and, D3, (Fig.1 and abstract) for a current measurement via the associated magnetic field.
3. Claims 2-4: The herein defined additional features are all disclosed in a similar arrangement in D2 (cf. Figs. 1, 4 and page 9, lines 4-6).
4. Claim 5: D2 already discloses the use of an insulating material as a dielectric in a similar arrangement (cf. page 6, lines 4-7). Choosing an equivalent insulating material - silicon - cannot therefore be considered to involve an inventive step.
5. Claim 6: In such an arrangement, it is common practice for the skilled person to completely insulate the measurement device from the exterior to avoid the risk of electric shock. For example purpose only, see D4, col. 5, lines 3-4.
6. Claims 7 and 8: The herein defined additional features are all disclosed in a similar arrangement in D2 (cf. Fig. 4 and page 5, paragraph 3).
7. Claims 9 and 10: The herein defined additional features are all disclosed in a similar arrangement in D3 (cf. Abstract, col. 1, line 44 and col. 2, lines 64-67).

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/DK00/00376

8. Claim 11: It would be obvious for the skilled person, when measuring a magnetic field, to reduce as far as possible the influence of other disturbing magnetic fields which would effect the accuracy of the measurement.
9. Claims 12 and 13: See the pertinent parts of V.1 above.
10. Claim 14: When measuring a magnetic field, the choice of one well-known detector over another cannot be considered to involve an inventive step.
11. Claims 16 and 18: D1 already discloses the multiplication of the current and voltage values together to determine either a positive or a negative energy value. To the skilled person, this would suggest the contemplation of the respective polarity of the current and voltage values.
12. Claim 17: D1 (cf abstract) also discloses a digital means for determining a positive or a negative energy flow based on the multiplication of the current and voltage fault components. This would suggest the contemplation of the respective polarity of the current and voltage values. It would be obvious to the skilled person to determine the zero-crossing point if desirous of knowing the polarity of a voltage.
13. Claim 19: It would be obvious for the skilled person to choose a reference or a "constant" value to be above the noise level so that, for example, spurious noise signals are not mistaken for the reference value.

Therefore, the set of claims, not involving an inventive step, does not meet the requirements of Article 33(3) PCT.

However, in the light of the available prior art and bearing in mind points VIII below, a new independent claim directed towards a directional voltage/high-voltage detector, comprising voltage measuring means and current measuring means combined with an adequately expressed means, including for example the simulation of the voltage after the detection of a fault (cf. page 12, last paragraph), for determining the energy flow(direction) would appear to have satisfied the requirements of Article 33(2) and (3) PCT.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/DK00/00376

Re Item VII

1. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is these document identified therein (see also the PCT Guidelines PCT/GL/3 II, 4.4).
2. The description is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT.

Re Item VIII

1. The application does not meet the requirements of Article 6 PCT, because the following items are not clear:
 - 1.1 Claim 1: In the herein defined determination of the energy flow direction, it is unclear how this determination is actually performed.
 - 1.2 Claim 11: The expression "...the calculation circuit..." is unclear since there is no previous reference to a calculation circuit either in the present claim or in claim 1 upon which the present claim depends.
 - 1.3 Claims 12, 13, 16 and 18: The features defined in claims 12 and 13 are already defined in claim 1, upon which both said claims ultimately depend. Thus, claims 12 and 13 are rendered unclear. The same repetition also occurs with claims 16 and 18 with respect to claim 15.
 - 1.4 According to the requirements of Rule 11.13(m) PCT the same feature shall be denoted by the same reference sign throughout the application. This requirement is not met in the use of reference sign (17) in claims 11-13.

TENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference P 99 035 W0	FOR FURTHER ACTION		see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/DK 00/ 00376	International filing date (day/month/year) 07/07/2000	(Earliest) Priority Date (day/month/year) 12/07/1999	
Applicant JOMITEK ApS			

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawing** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1
☐ Non of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

/DK 00/00376

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01R15/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 1 195 775 A (UNIV ZHEJIANG) 14 October 1998 (1998-10-14)	1, 12, 14, 15, 17-22
Y	sse abstract	2-4, 7-10, 18
Y	EP 0 809 115 A (YAMAMOTO) 26 November 1997 (1997-11-26) figure 1	2, 3, 18
Y	EP 0 071 560 A (SIEMENS) 9 February 1983 (1983-02-09) figure 1	4, 7, 8
Y	DE 31 45 255 A (BBC) 19 May 1983 (1983-05-19) figure 4	4
	--- -/-	

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

25 September 2000

Date of mailing of the international search report

29/09/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Hoornaert, W

INTERNATIONAL SEARCH REPORT

International Application No
DK 00/00376

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>US 5 438 256 A (COLLET)</p> <p>1 August 1995 (1995-08-01)</p> <p>figure 1</p> <p>-----</p>	9,10

INTERNATIONAL SEARCH REPORT

tion on patent family members

national Application No

T/DK 00/00376

Patent document cited in search report		Publication dat	Patent family member(s)		Publication dat
CN 1195775	A	14-10-1998	NONE		
EP 809115	A	26-11-1997	JP 9311146	A	02-12-1997
			CN 1172259	A	04-02-1998
EP 71560	A	09-02-1983	DE 3129901	A	10-02-1983
			BR 8204310	A	19-07-1983
			DE 3266795	D	14-11-1985
			JP 58026271	A	16-02-1983
DE 3145255	A	19-05-1983	NONE		
US 5438256	A	01-08-1995	FR 2693275	A	07-01-1994
			DE 69323514	D	25-03-1999
			DE 69323514	T	26-08-1999
			EP 0583993	A	23-02-1994
			ES 2129506	T	16-06-1999
			JP 2617269	B	04-06-1997
			JP 6160436	A	07-06-1994